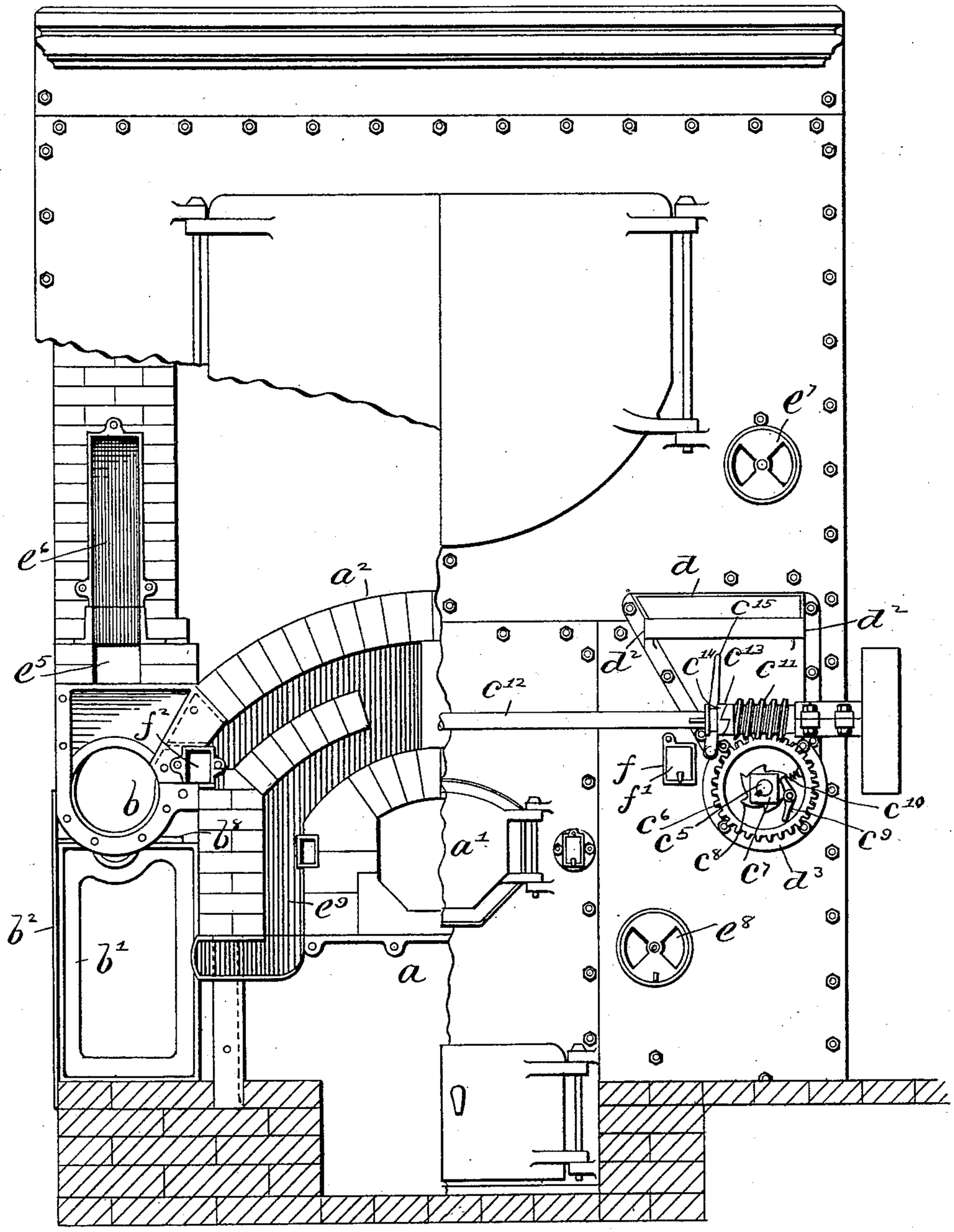
(No Model.) 4 Sheets—Sheet 1.

G. L. K. MORROW.

FURNACE.

No. 602,643. Patented Apr. 19, 1898.

Fig. 1



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(No Model.)

4 Sheets—Sheet 2.

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FURNACE.

No. 602,643.

Patented Apr. 19, 1898.

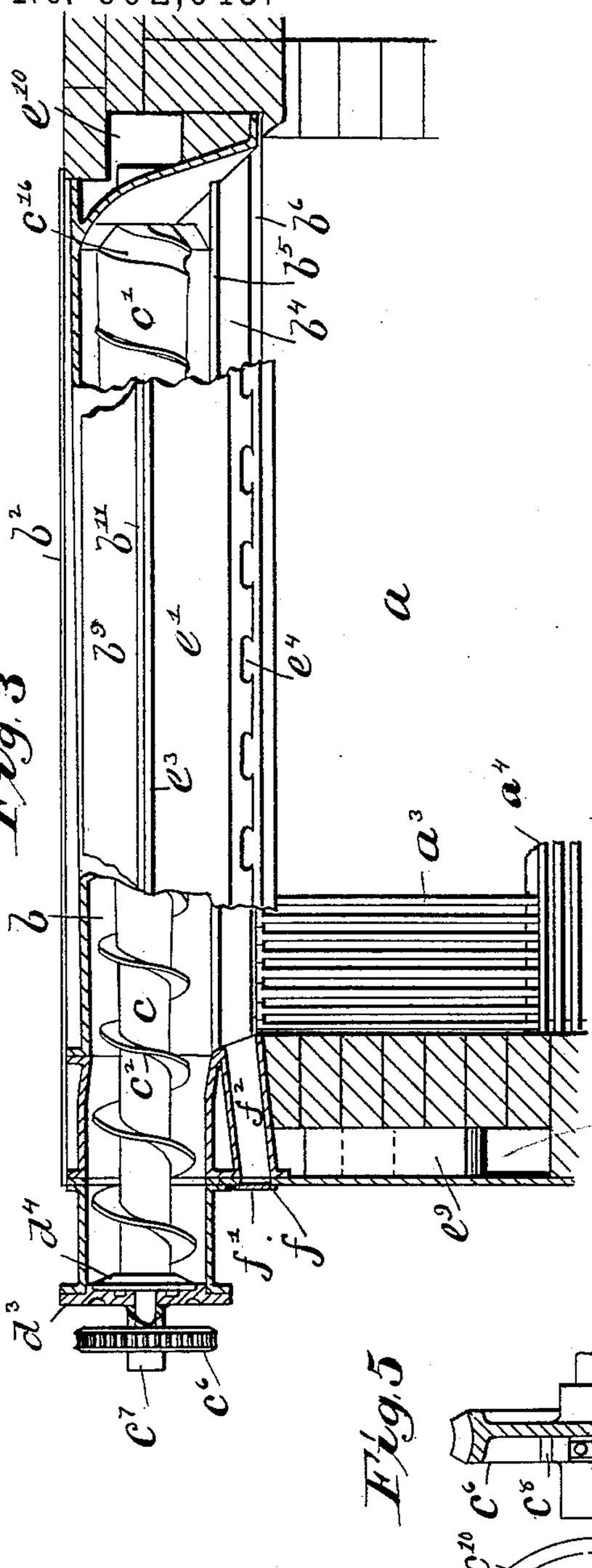

Fig. 3

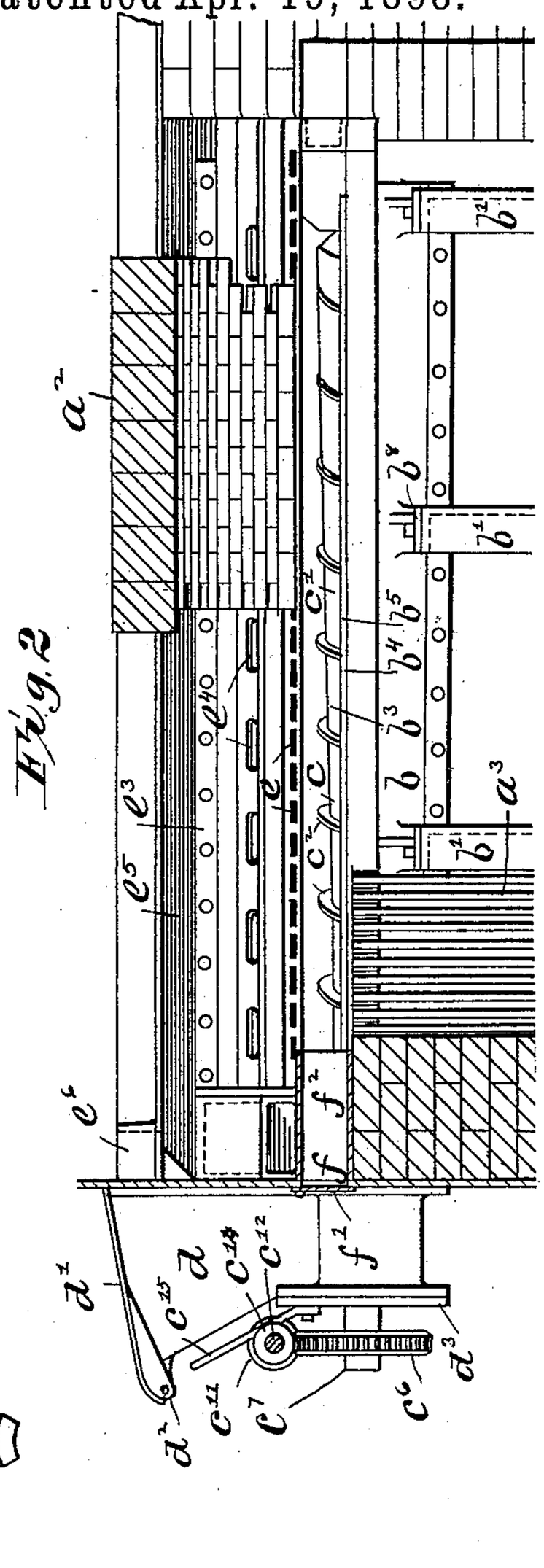

Fig. 2

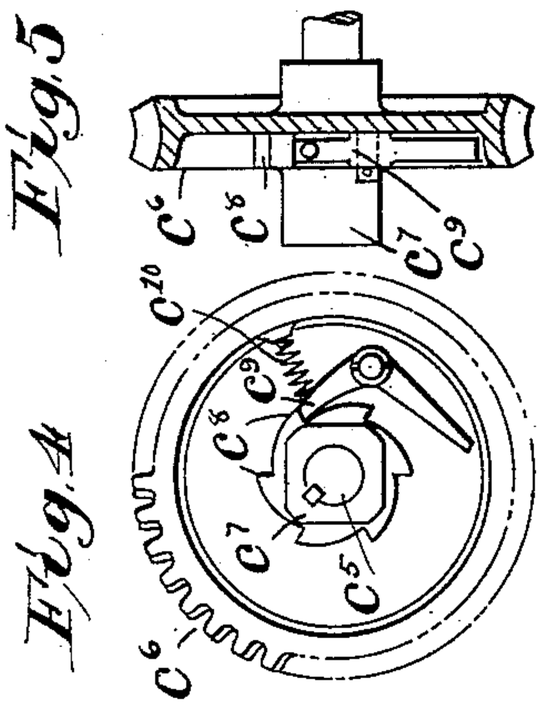

Fig. 5

Fig. 4

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Fig. 6

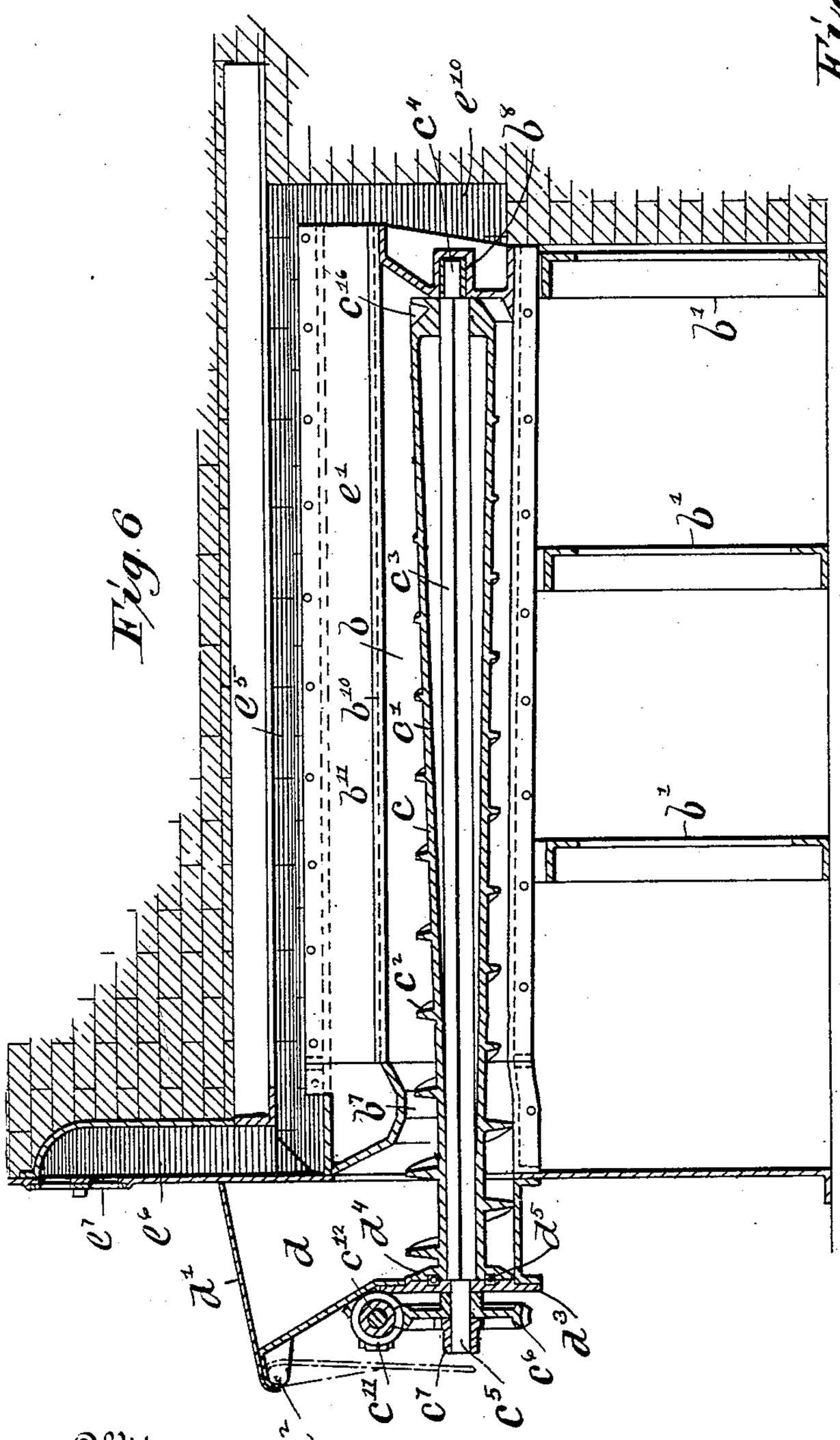


Fig. 9.

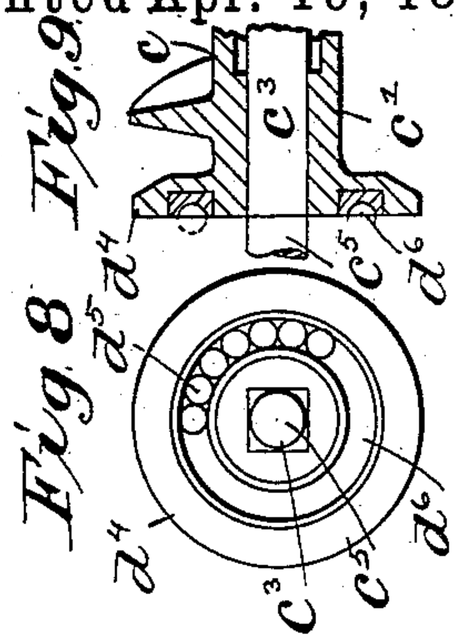
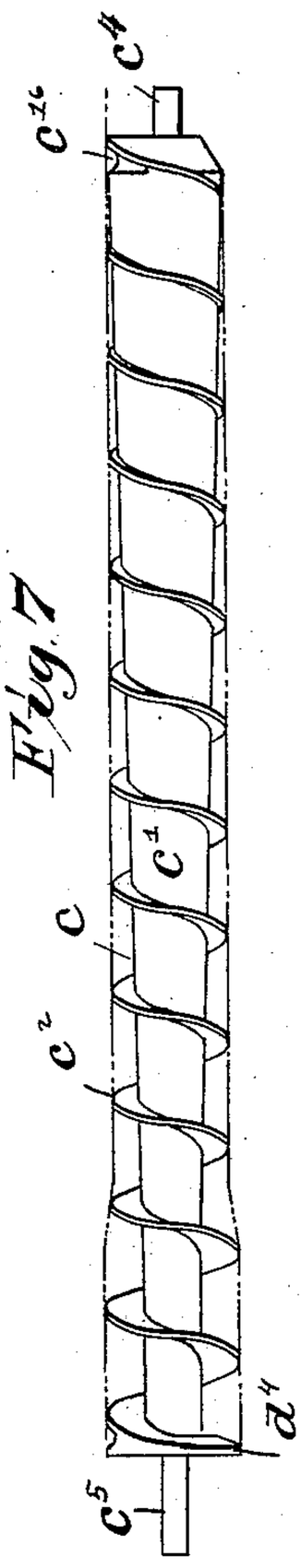


Fig. 8

Fig. 7



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FURNACE.

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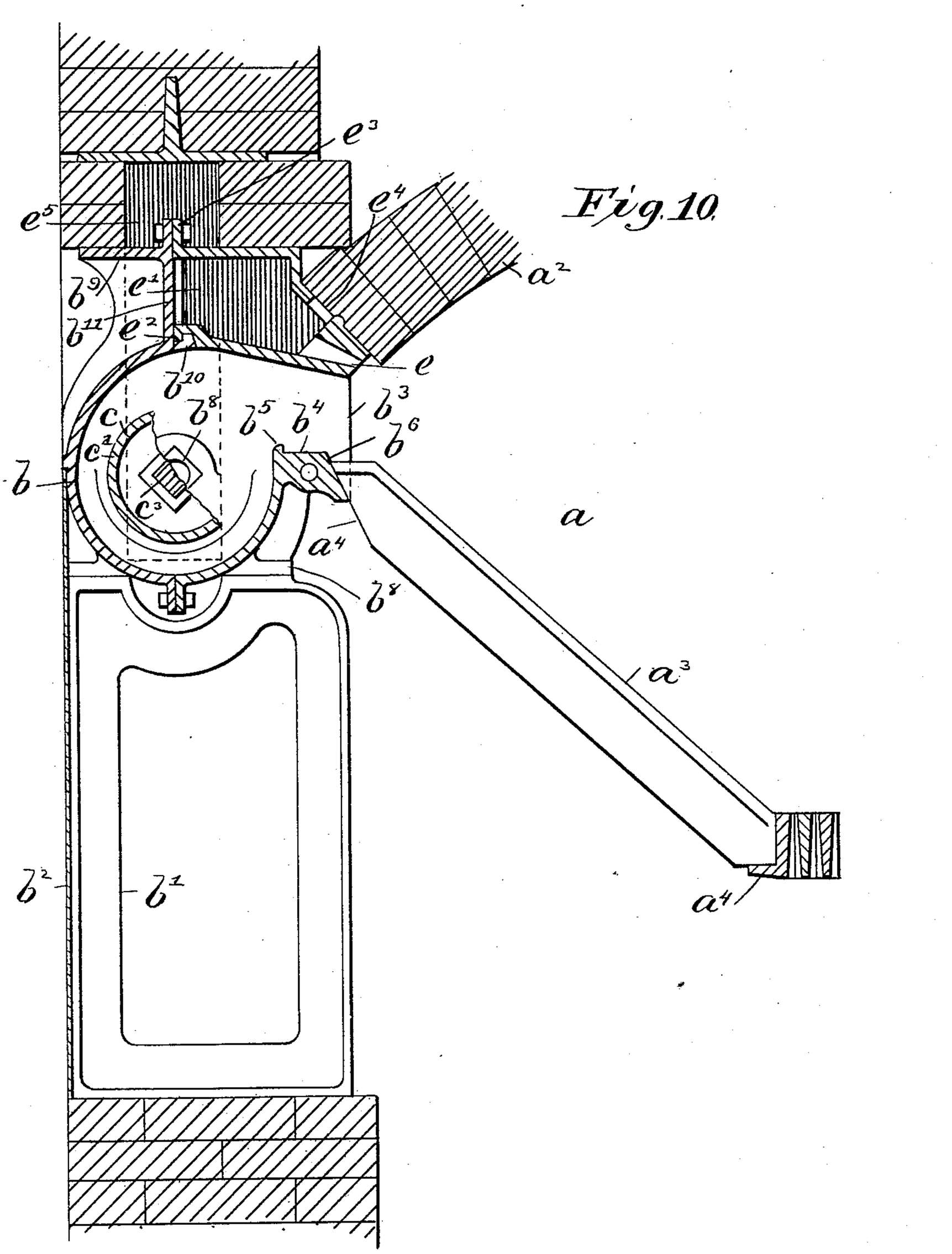

Fig. 10.

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UNITED STATES PATENT OFFICE.

GEORGE L. K. MORROW, OF DETROIT, MICHIGAN.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 602,643, dated April 19, 1898.

Application filed March 6, 1897. Serial No. 626,336. (No model.)

To all whom it may concern:

Be it known that I, GEORGE L. K. MORROW, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

My invention relates to improvements in furnaces especially adapted for steam-boilers; and it especially relates to that class of furnaces known as "smokeless" furnaces.

The objects of my invention are to provide means for furnishing the fuel to the furnace in a regular and uniform manner, to provide for furnishing the necessary oxygen to support combustion and consume the smoke, and, in general, to improve upon furnaces of this class so as to render them more simple in construction and economical in operation. I accomplish these objects by the constructions shown in the accompanying drawings, in which—

Figure 1 is a front elevation of a furnace embodying my invention, part of the front of the same being removed to more clearly illustrate the constructions thereof. Fig. 2 is a longitudinal sectional view of a portion of the same, showing the feeding and air-supplying devices. Fig. 3 is a plan view of part of the same, some of the parts being shown in section to more clearly illustrate the working parts. Figs. 4 and 5 are detail views of a portion of the driving devices for the feeding devices. Fig. 6 is a longitudinal sectional view extending through one of the feeding-conveyers. Fig. 7 is a plan view of the conveyer removed. Figs. 8 and 9 are details of the thrust-bearings for the same. Fig. 10 is a partial transverse sectional view of the furnace and the feeding devices.

Like parts are represented by similar letters of reference in the several views.

In the said drawings, a represents the furnace proper, which may be of any suitable size or shape and provided with the usual fire door or doors a' at the front and also preferably formed with an arch a^2, of fire-brick or similar material, which extends over the furnace proper. The grate-bars a^3 are preferably placed at an angle and extend inwardly and downwardly from the sides of the furnace and rest upon any suitable support a^4 at the bottom in a well-known manner.

At each side of the furnace and extending longitudinally along the same is a conveyer-box or feed-box b, which is preferably supported at suitable intervals by supporting-stands b', which may be connected at the outside by boiler-plate or similar sides b^2 to inclose the ash-pit and furnace and thus constitute a part of the furnace-walls. The conveyer or feed box b is provided near the top and at one side with an opening b^3, which stands above and at the side of the upper end of the inclined grate-bars a^3. The side of the conveyer-box is provided with a ledge or shelf b^4, having thereon a longitudinal rib b^5, which extends along said ledge or shelf and projects upwardly for a slight distance into the conveyer-box or the discharge-opening b^3. The side of the ledge or shelf is formed inclined or beveled, as shown at b^6, the back of the grate-bar at its upper end being similarly beveled or inclined, as shown at a^4, to rest in contact with this part of the conveyer-box and be supported thereby. This peculiar construction of the inclined surfaces, which are arranged at an angle to a horizontal as well as a vertical plane, is such that the grate-bars are supported on an inclined surface substantially in the plane of the bars, and any change in the length of the grate-bars by expansion or contraction permits the upper end thereof to simply move along the inclined surface b^6 without in any way interfering with the operation of the feeding devices hereinafter to be described.

There is arranged in each of the conveyer or feeder boxes b a feeding-conveyer c. This conveyer extends throughout the entire length of the feeder or conveyer box and into the hopper d, which forms a continuation of said box and which is bolted or otherwise secured to the furnace-front. The hopper d is supplied with a door d', hinged at d^2 and adapted to turn downwardly when opened, as indicated in dotted lines in Fig. 6, to protect the driving-gear of the conveyer in the manner hereinafter more fully specified.

The conveyer is formed of a peculiar and novel shape. It preferably consists of a sleeve or hub c', having on the outside there-

of screw-flanges c^2, which extend from one end of the hub or sleeve to the other. Beginning at the hopper end of the conveyer the hub or sleeve is of substantially uniform diameter until it passes into the conveyer-box proper. The screw-flanges are also of a substantially uniform diameter within the hopper portion and of a larger diameter than those in the feeder or conveyer box proper. The communicating conduit between the hopper d and the conveyer-box b is formed with a contracted neck or throat b^7, the approaches thereto being inclined in each direction, as clearly shown in Fig. 6, so that the interior of the conveyer-box is larger than the entrance thereto, thus forming a clearance for the fuel as it enters the conveyer-box. The conveyer is at the same time materially reduced at this point, so that its carrying capacity is reduced. From this point on into and through the conveyer-box the conveyer-flanges remain of a uniform diameter, while the conveyer hub or sleeve c' is gradually increased in diameter until it corresponds to the diameter of the flanges at the end of the conveyer, when the screw-flange substantially disappears. This, it will be seen, forms a materially-decreased carrying capacity of the conveyer at a point opposite the front of the furnace, from which point on the carrying capacity of the conveyer is decreased gradually and uniformly until it reaches a point opposite the rear of the furnace. To provide for the proper clearance of the coal or other fuel fed thereby between the sides of the conveyer-box and the conveyer hub or sleeve, I also form the conveyer-box of a gradually-increasing diameter from front to rear, so that the bottom line of the conveyer-box, as well as the bottom of the conveyer-hub, is arranged at an angle to the center line of the conveyer. This peculiar arrangement and construction I have found to produce a uniform and even distribution of the coal or other fuel fed by the conveyer from the hopper d through the opening b^3 into the furnace and onto the inclined grate-bars a^3 thereof.

For supporting and driving the conveyers I preferably employ a square shaft c^3, which extends through the hub or sleeve and is turned down at each end to form spindles or journals c^4 c^5. Of these the journal c^4 is mounted in a suitable bearing b^8, formed at the rear and preferably cast onto the conveyer-box b. The journal c^5 has a bearing in front of the hopper d, and has also mounted loosely thereon a worm-gear c^6, and secured rigidly thereto on the outside of said worm-gear a clutch-collar c^7 of square or other polygonal form. This clutch-collar c^7 is provided adjacent to the worm-wheel c^6 with a series of ratchet-teeth c^8, and there is secured to the web or other portion of the worm-gear c^6 a pawl c^9, which normally engages one of said ratchet-teeth and is held into engagement therewith by a spring c^{10}. Each of the worm-gears is normally engaged by a worm c^{11}, mounted on a transverse shaft c^{12}, which extends across the furnace-front and receives power from any suitable source of supply. Each of the worms c^{11} is preferably mounted loosely on the shaft and has at one end a clutch c^{13}, adapted to be engaged by a clutch-collar c^{14}, which is splined to the shaft, so to turn therewith, but is capable of being moved longitudinally by a lever c^{15} to throw the worm out of gear, so that either of the conveyers may be disconnected from the driving-shaft c^{12}, and thus temporarily stop the feeding of either of said conveyers, if desired, while the shaft continues to rotate. The arrangement of the pawl and ratchet between the conveyer-shaft proper and the worm-shaft, in connection with the square or polygonal-formed clutch-collar c^8, permits the worm to be turned by hand through the agency of a suitable wrench fitted on said collar, if desired, while the worm-gears remain stationary. By throwing the pawl out of engagement with the ratchet-teeth the conveyer may be rotated in a reverse direction, so as to withdraw the coal or other fuel from the conveyer-box should occasion demand.

It will be understood from the above description that the coal or other fuel placed in the hopper is fed uniformly and continuously, if desired, into the conveyer-box and thence onto the ledge or shelf b^4 and into the opening b^3 into the furnace proper. The fuel as it comes gradually and uniformly from the conveyer-box will be coked upon the shelf b^4, and as it is coked it will gradually be forced into the furnace. To provide for consuming the smoke and gases driven out by the coking process, I form above and slightly in front of the opening b^3 a series of twyers e. These twyers e communicate with and are substantially a part of an air trunk or box e', which is arranged above and along the conveyer-box b. In forming the conveyer-box I provide at suitable intervals supporting-flanges or feet b^8, which rest upon the stands b'. The upper portion of the conveyer-box is provided with a corresponding flange b^9, which extends above and throughout the length of the conveyer-box to form a support for the furnace-wall. The upper part of the conveyer-box is formed in two parts, of which the air box or trunk e' constitutes an essential feature. The box proper is constructed with a projecting lip or projection b^{10} and a vertical flange b^{11}, rising from a point adjacent to said lip or projection b^{10} to a point above the wall-supporting flange b^9. The air-box e' has a hook-shaped projection e^2, which engages with the lip or flange b^{10} and is provided with a web or flange e^3, which rests in contact with and is adapted to be bolted to the flange b^{11}. This air-box, which completes the support for the furnace-wall, also constitutes the top of the front portion of the conveyer-box. The front of this air-trunk, where it extends down to the twyers, is formed at an angle and constitutes a skewback to

support the arch a^2. At intervals the air-trunk is provided with openings e^4 through the metal parts, which openings are closed by the brick of the arch a^2, so that the brick forms a portion of the wall of the air-trunk, and as the brick becomes heated it imparts a portion of its heat to the air passing through the trunk, so as to heat the air before it is discharged from the twyers.

Immediately above the air-box e' and preferably formed in the wall of the furnace is an air-conduit e^5, which extends along the entire length of the air-box e' and communicates through a vertical flue e^6 with a register e^7 in the furnace-front. (See Fig. 1.) The furnace-front is preferably provided with a register e^8, which communicates through a flue e^9, passing through the walls of the furnace-front, with the air-box e. The flue or conduit e^5 also communicates with the air-box e' at the rear, as shown in Fig. 6, the said flue or conduit being extended downwardly past the end of the air-box, which is open at the rear, the said conduit being extended so as to form a chamber e^{10} at the rear and around the conveyer-box b, as shown in Fig. 6. It will be seen that the quantity of air admitted to the twyers may thus be regulated by the registers e^7 and e^8. At the same time the air, passing through the furnace-walls, becomes heated before reaching the air box or trunk and is further heated by the peculiar construction of said air box or trunk in connection with the furnace-arch.

Occasions may arise when the feeding of the fuel by the conveyers may be stopped for various reasons with a fire in the furnace, and if it should remain stopped for any length of time the fire will communicate with the coal in the feeding-box. To obviate this, I provide in the furnace-front, at a point adjacent to the front end of the shelf b^4, an opening f, preferably provided with a door f', and I provide in the furnace-front a passage f^2, extending on a level with said shelf from said opening to the coking-chamber in the front of the conveyer-box. This permits the insertion onto said shelf of a flat bar, which, engaging with the rib b^5, may be made to pass over the surface of said shelf and remove the coal from the coking-chamber above said shelf into the furnace. By turning the conveyer-shaft in a reverse direction in the manner hereinafter described the coal within the conveyer-box can be withdrawn into the hopper, and thus the danger of igniting the coal in the conveyer-box will be obviated.

To assist in removing the coal from the conveyer-box in case the occasion should demand, as before stated, I preferably form in the end of the conveyer hub or sleeve a groove or channel c^{16}, which extends backwardly a short distance from the end of said conveyer, so as to form a rib which is practically a continuation of the screw-flange of said conveyer. This channel assists in engaging any coal or fuel which is at the end of the conveyer-box, so as to start it backward along the conveyer, and thus withdraw it from the conveyer-box when the conveyer is turned in the opposite direction.

To provide for removing the conveyers, or either of them, as occasion may require, I construct the hopper-front with a removable plate d^3, circular in form and adapted to close an opening of a slightly greater diameter than the greatest diameter of the conveyer flange or flight. This plate is preferably bolted or otherwise removably secured to the hopper, and when the same is removed the conveyer may be withdrawn from the conveyer-box for repairs or otherwise. The conveyer-hub is preferably formed at the front with a beveled projecting flange d^4, which lies adjacent to said plate, and between this flange and the plate I provide a series of antifriction-balls d^5, adapted to operate in a ball-race d^6 in a well-known manner to receive the thrust of the conveyer and reduce the friction between the parts.

It is thought that the full operation of the device will be understood from the above description. The coal is fed into the hopper, and as the conveyers revolve it is carried into the conveyer-box and by reason of the peculiar shape of the hopper is uniformly and evenly distributed into the coking-chamber formed at the front and top of the conveyer-box and between the shelf and twyers. The arrangement of the air-supply, at all times under the control of the operator and by which the air is heated before passing into the twyers at a point immediately above the coking-chamber, produces a combustion which consumes the smoke and gases, while at the same time the feeding-conveyers deliver the coal onto the inclined grate-bars, thereby diverging it to the center of the furnace as it is consumed, so that the refuse may be readily discharged from said furnace in a suitable manner.

By the arrangement of the shelf and the adjacent opening as described the partially-coked or fresh coal may be discharged by hand appliances from the coking-chamber into the furnace and the coal in the conveyer-box removed through the hopper by reversing the action of the conveyer by hand or otherwise.

The arrangement of the hopper-door, which turns down when the hopper is opened, so as to protect and inclose the feeding worm and gear, protects the driving mechanism from dust and dirt, which might otherwise drop into the same as the fuel is supplied to the hopper.

Having thus described my invention, I claim—

1. In a furnace, inclined grate-bars extending upwardly and outwardly toward the sides of said furnace, a feeding device arranged on each side of said furnace on the outside of and adjacent to the upper ends of said inclined grate-bars, said feeding device consisting of a screw conveyer arranged in a conveyer-box extending longitudinally along

said furnace, said conveyer being gradually increased in diameter to reduce the carrying capacity, while the conveyer-box is increased in diameter to form a substantially uniform clearance, and a coking shelf or chamber between said conveyer and grate-bars, substantially as specified.

2. The combination with the inclined grate-bars, of a feeding-conveyer having a central hub or sleeve of a gradually-increasing diameter and the conveyer flights or flanges of a uniform diameter, and a conveyer-box of gradually-increasing diameter, of a coking shelf or chamber arranged between said conveyer and said inclined grates, substantially as specified.

3. The combination with the inclined grates, and a screw conveyer, a conveyer-box in which said conveyer is located, a coking shelf or arch between said conveyer and the grates, a stationary rib or ledge on said shelf, and an opening adjacent to the end of said shelf or arch, substantially as and for the purpose specified.

4. In a furnace, the combination with a conveyer-box extending into or adjacent to said furnace, a hopper located on the outside of said furnace, a contracted neck or throat between said hopper and conveyer-box, said conveyer being formed with flights of a uniform carrying capacity at a point opposite the contracted throat, at which point the carrying capacity is reduced by reducing the diameter of said flights, the carrying capacity of said conveyer being further reduced by gradually increasing the diameter of the central hub or shaft of said central conveyer while the diameters of the flights remain uniform, substantially as specified.

5. The combination with a conveyer-box, a conveyer mounted therein, said conveyer having flights of a uniform diameter in said box, the central hub or shaft of said conveyer being gradually increased in diameter to reduce the carrying capacity, the conveyer-box being increased in diameter to form a substantially uniform clearance between the bottom of said conveyer-hub and the bottom of said conveyer-box, substantially as specified.

6. The combination with the conveyer and the conveyer-box, of a hopper as described, gear arranged on the end of said hopper for driving said conveyer, and a lid or door hinged to said hopper above said gear and adapted to turn down and form a cover for said gear, substantially as specified.

7. The combination with the conveyer and a conveyer-box, of an air-trunk, one wall of which constitutes a portion of said conveyer-box and the other wall a support for a fire-arch, the engaging surfaces of said air-trunk and conveyer-box being formed with intermeshing devices as described, and twyer-openings in said air-trunk arranged slightly above and in front of the discharge from said conveyer-box, substantially as specified.

8. The combination with the inclined grates, a conveyer-box arranged adjacent to the upper end of said inclined grates, a conveyer having a gradually-reduced carrying capacity in said conveyer-box, a coking shelf or chamber between said conveyer and said grates, a rib or ledge between said conveyer and shelf and opening adjacent to the end of said shelf, an air-trunk, one side of which forms a portion of said conveyer box or chamber and twyer-openings from said air-trunk immediately above and in front of said coking-chamber, substantially as specified.

9. In a furnace having inclined grates and a fire-arch as described, a feeding device arranged between said grates and arch, an air-trunk having twyer-openings adjacent to said arch, said air-trunk being adapted to support said arch and having the walls thereof cut away to form a heating connection between said arch and air-trunk, substantially as specified.

10. The combination with the feeding-conveyer and the conveyer-box, a shaft extending through said conveyer-box, a gear journaled on said shaft, a clutch-collar secured to said shaft adjacent to said gear and having ratchet-teeth as described, and a pawl adapted to engage and disengage said ratchet-teeth, substantially as and for the purpose specified.

11. The combination with the feeding-conveyer and its supports, a worm-gear journaled loosely on the conveyer-shaft, and a worm to engage said gear, a ratchet-wheel secured to said shaft, and a pawl to engage said ratchet, substantially as and for the purpose specified.

12. The combination with the feeding-conveyer and the coking-chamber adjacent thereto, an air-trunk having twyer-openings arranged adjacent to said coking-chamber, air-flues extending from the furnace-front and through the furnace-walls so as to communicate with the opposite ends of said air-trunk, and means at the furnace-front for regulating the openings to said flues, substantially as specified.

13. The combination in a furnace with the conveyer and the conveyer-box, an air-trunk arranged adjacent thereto having twyer-openings as described, an air-flue extending from the furnace-front through the furnace-walls and adjacent to said conveyer to an air-chamber formed at the rear of said conveyer-box, and an opening from said air-chamber into the air-trunk, substantially as specified.

14. The combination with a conveyer-box and a hopper as described, a conveyer extending through said box and into said hopper and having a shaft journaled at the respective ends in said conveyer-box and hopper, a gear mounted adjacent to said hopper and turning loosely on said shaft, a clutch-collar secured to said shaft adjacent to said gear and having ratchet-teeth as described, said clutch-collar being formed with polygonal sides to receive a wrench, a pawl on said gear to engage said ratchet-teeth, and means for rotating said gear, substantially as specified.

15. The combination with the conveyer and a conveyer-shaft, a worm-gear arranged loosely on said shaft, a ratchet-wheel secured rigidly to said shaft, and a pawl on said gear to engage said ratchet-wheel, a driving-shaft having a worm to engage said worm-gear, said worm being mounted loosely on said shaft, and a clutch splined to said shaft and adapted to be moved into or out of engagement with said worm, substantially as specified.

In testimony whereof I have hereunto set my hand this 27th day of February, A. D. 1897.

GEORGE L. K. MORROW.

Witnesses:

R. A. MORROW,

PAUL E. DAVIS.